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RHEUMATOID ARTHRITIS.

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by

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Introduction.

The disease designated Rheumatoid Arthritis is one of great antiquity, and the various anatomical and morbid changes produced by the disease have been the subject of much controversy by clinicians for the past century. The fact that these changes are so much allied to rheumatism and gout led the early observers of the disease to classify it under one of them; the similarity of rheumatism was apparent in the joint lesions, whereas the strong resemblance to gout was manifested by the nodes and increscences around the joints. Having had the opportunity of observing a series of nine cases of this condition I have thought a thesis dealing with this subject would be of interest. In the present thesis I have accordingly treated fully of this condition paying special attention to recent work on the subject.

Historical Outline.

Mr. Flinders Petrie¹ collected in Gurot a town of Lower Egypt some bones showing evidence of the disease, and having an approximate date B.C. 1300, and also upon Egyptian bones of the Ptolemaic period collected by Eve².

Again signs of the disease were detected by Della Chiaja³ in bones dug up from among the ruins of Pompeii, and in bones from the catacombs of Paris by Lebert⁴. The same changes were also seen in skeletons obtained from the graveyard of the ancient convent of Marienthon in Pomerania (Virchow, 1869), and at a meeting of the Pathological Society of London on 3rd March, 1883, Dr. Norman Moore exhibited some vertebrae showing rheumatoid arthritic changes which had been found in a Roman tomb discovered in digging the foundation of the Library at St. Bartholomew's Hospital. The vertebrae showed lipping of the edges, irregularities on the intervertebral surfaces, and in some places ankylosis with considerable formation of osseous tissue. The St. Bartholomew's tomb was ascribed by antiquarians to the fifth century and perhaps furnished the earliest instance of the disease in England; at the same meeting Mr. Bruce Clark said there was a specimen in the museum of Oxford which the late Professor Rolleston had frequently stated was obtained from tumuli which

he considered antedated the Christian Era (B.M.J. of 1883), lastly the skeleton of the Norse Viking found burned in his warship in the neighbourhood of Christiana Fjord showed unmistakable evidence of the disease.⁵

Sydenham in 1683 mentioned the condition as a modification of rheumatism and spoke of its occurring ⁱⁿ paroxysms like gout, and of the general crippling and nodosity of the joints of the fingers caused by it. The subject was referred to by Musgrave in 1703,⁶ in 1764 by Haller⁷ and by De Sauvages⁸ in 1768. In 1800 Laudre Beauvais was the first to differentiate this affection under the name of "Goutte asthenique primitive" in his thesis. Four years later, 1804, Heberden says, "The disease called chronical rheumatism which often passes under the general name of rheumatism and is sometimes supposed to be gout, is in reality a very different distemper from the genuine gout, and from the acute rheumatism, and ought to be carefully distinguished from both."

In 1805, Haygarth of Bath published an essay on the disease and described the changes under the name of "Nodosities of Joints" and drew attention to the fact that in all, or nearly all the cases the hands, chiefly the fingers, were affected, the joints becoming distorted and their motions much impaired.

Todd in 1843 described the disease as "Chronic

Rheumatism of the Joints."

Vidal and Charcot in 1855 as *Rheumatisme Chronique Primitif*.

Adams in 1857 as *Chronic Rheumatic Arthritis* or *Rheumatic Gout*.

A. B. Garrod in 1859 as *Rheumatoid Arthritis*.

Senator in 1869 as *Arthritis Deformans*.

Spender in 1888 as *Osteo Arthritis*, a name also given to it by Virchow in Germany.

With all these names it is difficult to come to any clear understanding of the true conception of the disease, and not until Garrod wrote of it as *Rheumatoid Arthritis* was it separated from gout on the one hand, and rheumatism on the other; and even then it was some time before the disease was looked upon as a separate entity, hence it is only recently that any practical value can be placed on the reports of the disease.

The multiplicity of names seems to have arisen from the fact that each clinician gave a name descriptive of the symptoms most pronounced in the cases he had considered.

Reviewing these, the name *Arthritis Deformans* seems to be the most descriptive of the malady, although in the early stages the joint changes are not marked so prominently, yet this name keeps before the observer the ultimate results that are to be

expected, and points out a course of treatment which is opposite and opposed to that for rheumatic conditions, it also keeps clear of the debatable ground of rheumatism and gout.

Etiology.

Rheumatoid Arthritis is a disease of the joints, with an intermittently progressive tendency to degeneration of the various structures which enter into the formation of the joint, resulting in marked deformity which renders them incapable of performing their functions. It is associated with pain which is accentuated on movement and previous to cold and damp weather.

The etiology of Rheumatoid Arthritis is extremely obscure and the attempts to assign an origin for the disease consist in an enumeration of the causes commonly met with in the various cases.

Sex and Age. The affection shows undoubtedly a predilection for attacking the female sex.

A. E. Garrod states on examination of 500 cases the number of female cases increases steadily with every five-year period until that between 45-50 was reached, and that after this the number steadily declined.

Llewellyn-Jones states that out of a series of 240 cases of rheumatoid patients there were 39 males to 201 females, a proportion of 1-5 or 16.25 per cent and 83.75 per cent respectively.

In another series of 150 cases of his, the following varying incidence in the several decades is shown.

0-10.10-15.15-20.20-30.30-40.40-50.50-60.60-70.

Females	2	6	24	37	24	26	9	0.
Males.	0	1	1	6	11	3	0	0.

Odery Symes attributes the greater prevalence of the disease in women than men to the number which follows parturition and lactation and those which arise at the climatric period.

The majority of cases occur between the ages 30-50 years, the period of commencing tissue degeneration. It may occur in early childhood but cases are rare and it is more common towards the other extreme of life.

Again, the disease is much more common in women of the poorer classes, who have been subjected to cold, damp and hardships, with a minimum amount of food. At the climatric period the general health of women is lowered, her resisting powers lessened and are more liable to suffer from diseases of the reproductive system and of such diseases those most productive of rheumatoid arthritis are such as are associated with exhausting discharges from the uterus especially haemorrhages or copious muco-purulent discharges.

At the New Hospital for Women (Encyclopaedia Medica) the occurrence of rheumatoid arthritis associated with menorrhagia due to fibroid tumours has been frequently observed, and Dr. Ord has also re-

marked this fact.

Dr. Garrett Anderson writing on the menopause states as follows. Perhaps the worst thing that can be said of the menopause is that it heralds the wearing out of that part of the organism which is specially connected with the maturity of the individual, and that when wearing out begins other signs of degeneration of tissues may not be long in appearing, and in a large number of cases the menopause is associated with the commencement of rheumatoid arthritis and whether the primary fault is nervous, nutritional or chemical is not at present known.

Garrod points out its frequency in association with too rapid child bearing and over-lactation, both debilitating conditions.

It is probable that any cause which produces a lowering of the general health and failure of nutrition may predispose to the disease and in women pelvic disorders form a considerable proportion of the causes of ill-health and it is what should be expected that these disorders should take a prominent place in preparing the system for rheumatoid arthritis.

Heredity does not seem to have any influence as seldom can a history be obtained in the patients antecedents, and where obtained the conditions of

life, the locality, and surroundings are usually identical. The incidence of the disease is greatest in cold, damp, low-lying districts, especially those subject to fogs and mists and easterly winds.

Charcot believes damp and cold to be one of the most potent factors, and Bannatyne states that the disease is more common in the humid air of Ireland than in England. Adams speaks of its prevalence in Holland whereas Stewart states it is rare in the dry climate of Canada.

The combination of damp, cold, a low temperature, a low elevation and a minimum amount of sunshine is favourable to the development of the disease, or in other words the climate least likely to lead to good general health and vitality of the tissues.

With regard to the acute infectious disorders a noticeable feature is the frequency with which influenza figures in the past history of rheumatoid arthritis.

Poynton has observed both in the subjects of rheumatism and rheumatoid arthritis a severe recrudescence of their respective joint troubles has often been observed to follow an attack of this disorder, and Llewellyn-Jones states that the toxins of influenza have an undoubted affinity for the nerve centres and whose effects are extremely lasting and if it could be proved that Pfeiffer's bacillus was present

in the joints in rheumatoid arthritis the associated trophic and vasomotor disturbances would be readily explained by coincident invasion of the nerve centres by its toxins.

Tubby in the Lancet (26th Dec. 1908) states that the weight of evidence in favour of the disease being an auto-toxaemia and Hester states that indications of abnormal intestinal putrefaction were regularly found by him in all cases of early rheumatoid arthritis.

Another theory as to the etiology which has received a considerable measure of support is the symmetrical manifestations of the disease, the existence of muscular atrophies and other suggestions of trophic disturbance known to depend on spinal lesions the exaggerated tendon-jerks and the apparent sequence of the disease on circumstances which have an exhausting influence on nerve force. This theory was first offered by Remak (1858) but before this date Scudamore suggested that the conditions were due to a slow perversion of nutrition.

Hyde states that in his experience no causes are more productive of this distressing malady than certain psychical conditions associated with anxiety and mental distress. Mental grief following bereavement, anxiety and long watching over sick rela-

tives, business worries and anxieties - these and similar causes are only too frequently immediate antecedents of this disease.

A recent theory of the nature and causation of rheumatoid arthritis teaches it to be dependent on a specific micro-organism and this is dealt with later under Bacteriology.

Bacteriology.

The suggestion of a microbic origin for certain cases of rheumatoid arthritis belongs to Schuller who in 1892 drew attention to the presence of organisms in cut sections from the tissues of the joints. These joints were anatomically characterised by villous hypertrophy and generalised thickening of the synovial membrane. In 1893 he identified the organism seen in cut section with those cultivated by him from the joint fluid. The organisms presented a dumbbell shape, but in exceptional cases the rods were very short and clumsy exhibiting but slight medial constriction and resembled gonococci while in others they showed a likeness to diplococci. They might be singly or in pairs like diplobacilli. The rods measured 1-27 by .25-.75m staining readily with carbol-fuchsin, methylene blue or Bismarck brown but not so easily with methyl violet. When cultivated on gelatine stabs on potato or agar, a white granular formation ensued and the cultures retained their infective potency even after the lapse of ten or twelve months when introduced into the joints of rabbits, lameness followed with enlargement of the joints which proved to be permanent. After the lapse of two months the animals were killed and the synovial membrane showed villous growth. He emphasised the fact that the organisms are to be

found more frequently embedded in the tissues than in the joint fluids and consequently in aspirating the needle should not be thrust into the joint cavity but only into the synovial membrane.

In 1893 Dor cultivated staphylococcus pyogenes albus and a gelatin liquefying organism from the shoulder joint of a man suffering from arthritis deformans and suggested that certain forms of the malady are of infectious origin.

In 1896 Bannatyne and Wohlmann discovered a bacillus which they considered to be the cause of the disease and their observations were confirmed by Blaxall who succeeded in cultivating the organisms.

In eighteen cases of rheumatoid arthritis an organism was discovered in the synovial fluid ~~the~~ the characteristics of which were constant. The organism is a minute bacillus exhibiting marked palor staining and can be grown in culture media. In beef broth it gives the appearance of gold dust, and on agar and serum its growth is almost invisible. The average length of the organisms is 2m and the average breadth .6, it is non-motile and does not occur in chains, it is stained by carbol fuchsin or methylene blue and completely decolorised by Grams method.

Chaufford and Ramond recorded seven cases of arthritis deformans and glandular enlargement and stated that in scrapings from the enlarged glands and in

in films prepared from the fluid of affected joints a short thin diplobacillus was found which stained readily by ordinary methods and was not decolorised by Grams method. Inoculations of triturated portions of the glands into culture media and animals proved negative.

In 1901, Painter states that he had failed to find Bannatyne's bacillus in cases of this malady.

In 1902, Poynton and Paine described a diplococcus found by them in a case of rheumatoid arthritis and by intravenous inoculation of rabbits produced not only a severe multiple arthritis but also an osteoarthritis.

In the same year Hale White obtained a coccus from the left knee joint of a case of acute rheumatoid arthritis. The organism was non pathogenic and was apparently not similar to that described by Poynton and Payne, it grew chiefly in pairs not in chains and was stained by Grams method. Crawford and Malim working at the Royal Mineral Water Hospital Bath, aspirated the joint fluid in 48 cases but no evidence of a specific organism was found, the majority of the cases proved sterile and in the few cases in which organisms were cultivated it was thought that they were the result of accidental contamination.

In 1904 Dr. McCrae in a series of 110 cases of arthritis deformans in Osler's Clinic was unable to

obtain any results by the methods described by Blon-
all.

Reviewing all these investigations a great want of harmony is seen in the bacteriological results both in the nature, growth, and shape of the organism and also in the results of inoculation and presuming the disease to be infectious in origin the only inference to be drawn is not one only but many different organisms may produce the disease and as Kanthack has observed "We may have clinical or pathological identity without bacteriological identity" as in pneumonia and endocarditis.

Morbid Anatomy.

Koffa writing on rheumatoid arthritis in 1908 ascribes the credit to Von Volkmann of the first clear differentiation of the anatomical lesions of the disease and this authority first established the fact that the initial changes began in the synovial membrane the cartilage being affected secondarily. He noted the marked thickening of the periarticular and synovial tissues and the subsequent atrophy and induration of the same likewise the occurrence of fibrous and bony ankylosis. Hyde states that the structures to be first attacked are uncertain but that no doubt the cartilages are early affected in the diseased process and Dr. A. E. Garrod corroborates this idea.

Adams writes of the synovial membrane being

thickened, and of a red colour on its inner surface, vascular tufts, red and hypertrophied synovial being seen in the joint. The inter-articular fibro cartilages are absorbed when the disease has existed long and not a vestige of the inter-articular fibro cartilage will be found in the post mortem examination of these joints if they have been long and severely affected. The semilunar cartilages of the knee have been absorbed as completely as the cortilages covering the heads of the bones.

Changes in the Cartilage.

The articular cartilage loses its polish and assumes a dull velvety appearance due to the breaking up and fibrillation of the superficial layers of cells. After a time this central zone gets worn down and disappears leaving a cavity with a more or less well defined margin at the bottom of which the denuded bone may be seen. With further extension of the disease the whole of the articular cartilage may become removed permitting the denuded heads of the bones to come into direct contact. But while the central portions of the cortilage are disappearing, formative changes are taking place at the periphery, the edges of the cartilage become thickened or heaped up or lipped around the margin. These imarginal lips, at first small increase in size, by the continued proliferation of the cartilages and eventually by the deposition of

lime salts they become transformed into bony masses or osteophytes.

M. M. Corneli and Ranvier attribute the difference between the central disappearance of the cartilage and the formative masses at the periphery to the fact that the articular cartilages at the edges are covered by synovial membrane, underneath which the proliferating cell elements accumulate instead of escaping into the cavity of the articulation. It was also thought that the disappearance of the central part of the cartilage was due to friction whereas the margins were not exposed to this influence.

c Coincident with the changes in the articular cartilages, the epiphyseal ends of the bones are undergoing changes. The surfaces are bared of their articular cartilage, the bone beneath shows a thin layer of greatly increased density, it is smooth, polished and dense like ivory, hence the term eburnation applied to the condition, its surface may be furrowed by friction of eminences of the opposing bone. The lipping and position of the osteophytes will more or less completely destroy the mobility of the joint, or alter its mechanism so as to under movements possible which could not be performed by a normal joint.

These marginal lippings and osteophytes may become fused together and produce a true bony ankylosis and when the thin layer of compact dense bone

covering the epiphyseal heads of opposing bones is worn through and cancellous tissue exposed, then again true bony union may takeplace.

Formation of loose bodies.

In the normal healthy state the synovial membrane is edged with fringes and villi, and these in the diseased condition of the joint participate in the general sclerosis of the synovial membrane becoming hard and dense, the pedicles which retain them may become stretched or broken from some unusual movement, or from degeneration, or want of nutrition, so passing into the joint as a free body, or some portion of the osteophytic outgrowths may become detached from twisting of the joint or injury. Adams states that Haller found twenty small cartilaginous bodies in the synovial sac of the lower jaw and Morgagni twenty-five in the left knee joint of an old woman. Some are small and others of considerable magnitude the consistency of these foreign bodies is various, sometimes they have the appearance of cartilage throughout their substance, some are bony in the centre and cartilagenous in their circumference and in certain cases they will be found to possess a softer cellular nucleus enveloped by a cartilagenous crust or covering, or they may be bony throughout.

Changes in the Synovial Membrane.

The synovial membrane is thickened and intern-

ally presents a red colour, there is hypertrophy of the synovial fringes. According to Bannatyne there is much redness and injection of the synovial membrane which appears soft, thick, and pulpy, there are excessive villous formations which are generalized over the synovial membrane. Llewellyn Jones states that the hypertrophied fringes vary widely both in their appearance and size. The smaller and more delicate, purple in colour are attached by a slender pedicle to the synovial membrane whose surface may be studded with these elongated processes. On the other hand they may be of considerable size when they present a yellowish colour and are coarsely lobulated in shape.

With regard to synovial effusion according to Painter there is very rarely any excess of the fluid in the so-called atrophic or rheumatoid arthritis but Jones states that he has seen in many cases under his observation an excess of fluid, usually of a viscous nature, often blood-stained or yellowish in colour.

Changes in the Bones.

As the central portion of the articular cartilage disappears the epiphyseal ends of the opposing bones is laid bare and the process of **eburnation** ensues. The heads of the bones are flattened and at the same time enlarged by the formative masses of the edges of the articular cartilage. As the heads of the bones are enlarged the cavities for their reception become

expanded and these sockets may be deeper or shallower according to the particular articulation affected, and the heads of the bones and sockets present ridges and depressions as a result of friction.

As a result of the wearing away of the articular cartilage, the eburnation and flattening of the heads of the bones and of the expansion of the sockets, the entire length of the limb is shortened and deformed.

Vasomotor and trophic changes. The skin over the hands and feet may be cold and clammy and blue and a combination of cold hands and feet with profuse sweating is characteristic.

Sweating confined to the hands, feet and upper lip is common, so also is nocturnal sweating. Definite areas of atrophy of the skin may be seen over the affected joints the so-called glossy skin. There may be definite patches of congestion, and distressing sensations of burning and pricking. Spender alludes to pigmentation of the skin which occurs in three forms, (1) as a general darkening of the complexion most marked in exposed parts, (2) as large patches in various places of irregular shape uniform in colour and with well-defined edges, (3) as more or less widely spread patches of small size like freckles, or splashes of paint, especially seen on the trunk and limbs, and parts exposed to pressure such as the waist and garter

areas. Pigmentation is present in a large number of cases but whether it is peculiar to rheumatoid arthritis is doubtful as it occurs in many chronic diseases especially those associated with failure of nutrition and also in apparently healthy subjects. Bannatyne mentions subcutaneous haemorrhagic effusions under the nails.

The nails are often dull and brittle and show longitudinal striation.

Bonchord found dilatation of the stomach in 273 out of 1000 cases of rheumatoid arthritis.

The condition of the Heart.

Garrod considers the absence of cardiac inflammation as one of the most diagnostic features and never traced the occurrence of peri- or endocarditis in any case.

Bannatyne in the B.M.J. in 1898 published two cases in which these conditions were well marked.

Dr. Katherine Clark noticed general thickening of the arteries in three cases in one of which the patient was only 24 years of age. In this case all the coats of the medium sized arteries showed marked thickening, especially the tunica intima which was thrown into folds, producing an irregular triangular shape in the lumen. Similar changes were found in the smaller arteries affecting the tunica media and adventitia and also the tunica adventitia of the veins.

The same observer found increased connective tissue in the portal tract of the liver with thickening of the walls of the ducts and vessels, the fibrosis in one instance being very marked. In three cases thickenings of the walls of the central artery of the malpighian body of the spleen were present being the nature of a hyaline degeneration. The capsule and trabeculae were also similarly affected.

Extensive increase of the connective tissue of the pancreas was noted with degeneration of the parenchyma, hyaline degeneration of the vessels and ducts with proliferation of their lining epithelium.

In one case total absence of the germinal epithelium and follicles of the ovary was seen with extensive fibrosis and hyaline thickening of the vessels, in the kidney also fibrosis of the organ and hyaline degeneration of the vessels and glomeruli were present.

Pathology.

There are three theories with regard to the causation of rheumatoid arthritis, two of which hold the field today. One attributes it to a nervous origin, the second attributes it to an infective origin, and the third attributes it to a disturbance of the internal secretions of certain glands or tissues.

Ord and Spender who have been the chief supporters of the nervous theory believe that the changes in the joints are secondary to reflex nervous disturb-

ance in the spinal cord. Diseases of the uterus, ovaries or other organs act upon the cord unduly irritable owing to debility and anaemia and the changes thus excited in the cord, influence reflexly the nutrition and health of the joints.

P. W. Latham thinks that the clinical symptoms in rheumatoid arthritis furnish undoubted evidence of pathological change in the nervous centres and points out the neurotic character of the antecedents and accompaniments of the arthritic trouble, as antecedents there are the neuralgic pains affecting one or more of the limbs, the feeling of weariness, numbness or tingling, As an accompaniment there is the marked atrophy of the muscles which develops more quickly than can be attributed to mere disuse.

Dr. Weir Mitchell, Dr. Moorhouse and Dr. Keen were the first to call attention to the effect of nerve injuries on the nutrition of the joints. The symptom occurs within a few days after the injury to the nerve it consists in a painful swelling of the joints which may attack any or all of the articulations of a limb and once fully established keeps the joint stiff and sore for weeks or months, when the acute stage has passed the tissues about the articulations become hard and partial ankylosis results. The objections to such a theory are that if the disease were purely nervous in origin several if not all the joints should

be attacked at the same time. The joint lesions which occur in certain nervous diseases - tabes, atanic paraplegia, chronic poliomyelitis, and neuritis - differ from rheumatoid arthritis as they are usually painless, are accompanied by much synovial effusion, do not limit the movements of the joint, and are accompanied by objective nervous phenomena. The nervous diseases which are associated with joint lesions are all represented by gross lesions of the cord, and no such changes have been demonstrated un rheumatoid arthritis except in a few cases.

The Infective Theory. Amongst those who attribute the disease to an infection are Bannatyne, Wohlmann, Schuller, Chaufford and Ramond and Hale White, but they are not agreed as to the specific nature of the organism, nor have the results of culture and inoculation been satisfactory.

Llewellyn Jones attributes the disease to a toxaemia which acts upon one or more segments of the spinal cord, and the prolonged course of the malady, its remissions, and exacerbations, with intervals of apyrexia alternating with pyrexial periods, are very significant of some intermittent discharge of toxins from a hidden focus into the general blood stream. Hesupports this view on certain features.

1. The history of previous infectious disorders, the co-existence of gastro-intestinal and genito-

urinary derangements and localised foci of septic absorption.

2. The occasional onset of muscular atrophy before joint lesions are present, the incidence of atrophy in muscles remote from the affected articulations, the rapidity with which widely-generalised muscular atrophy may take place, too swiftly, indeed, to be accounted for by disuse, and quite out of proportion to the severity of the arthritic lesions.

3. The frequency with which marked exaggeration of the deep reflexes is present.

4. The tendency to a centripetal spread of the joint lesions, from the periphery to the root of the limb, the ultimate symmetry of distribution obtained by the joint lesions, the tendency for the joint lesions to approximate a segmental arrangement coupled with a similar action to associated action on the part of certain superficial reflexes, such as the gluteal and plantar, which are governed by the same segment.

5. The ultimate dystrophic changes in the skin and subcutaneous tissue, as evidenced by atrophic changes, sensory and calorific disorders with loss of hair and trophic alterations in the nails, early localised sweats, followed in the later stages with cessation of the functions over the affected areas.

6. The resemblance of the muscular contractures

present in the terminal stages to those met with in diseases of the central and peripheral nervous system.

Hyde, while inclined to favour a purely nervous lesion as being the cause of the malady puts forward the internal secretions theory and asks, "How far may diseased processes of joints be influenced by disturbance of the internal secretions of certain glands or tissues?" The thyroid treatment of myxoedema has led to extensive inquiries into the general question of the physiological importance of certain other glands or organs, the real functions of which have been little understood in the past. Recent physiological research had established the fact that the so-called ductless glands possess special powers of secretion, and that their special secretions pass into the blood independently of ducts, also that glands with ducts, such as the liver and pancreas, secrete other secretions apart from those which pass out through their ducts, which secretions are taken up by the blood as in the case of ductless glands. To this class of secretions has been given the designation "internal secretions" to distinguish them from the secretions poured out through ducts which are now termed "external secretions." It also appears to have been proved beyond doubt that powers of secretion are not confined to glandular organs but that all organs of internal secretion and tissues possess and exercise this power of internal

secretion..

Professor E. A. Schafer has stated that some glands such as the liver and pancreas are more essential to life by reason of the internal secretions which they furnish to the blood than by their external secretions of bile and pancreatic juice. That the internal secretions of such glands as the thyroid, suprarenals, thymus and pituitary body play a no less important role in the physiology of life is abundantly proved. Another important fact is that some of these glands seem to act in concert with one another and even for one another, or

Hoffmeister performed thyroidectomy in rabbits and found that this was afterwards followed by structural changes in other glands, including the ovaries, kidneys, pituitary body, and also in the bony skeletons. It has also been observed that enlargement of the lymphatic glands follows removal of the spleen. It would thus seem necessary to healthy and normal nutrition of all parts of the animal organism that the various internal secretions should circulate in definite proportions, and combinations, maintaining in fact a sort of physiological equilibrium throughout the entire system, and it would further appear that when this equilibrium is disturbed either by an excess of by a diminution of one or other of the internal secretions, diseased conditions such as myxoedema, osteo-

malacia, and acromegaly are developed.

Again it has been proved that nutritional changes of a grave and pronounced character are often manifested in or about the joints and bones of the extremities in some forms of disease which are due undoubtedly to perverted supply of the internal secretions of certain glands. If this be so, may not some of those morbid conditions of joints generally looked upon as rheumatoid or gouty originate from such a cause. Since every tissue and every organ of the body furnishes an internal secretion peculiar to itself which exercises an important influence upon the process of metabolism, it should be borne in mind in studying the diseases of joints that the synovial fluid of joints and bursae is not the only secretion concerned. Hyde's conclusions are that the rheumatoid arthritis is a disease due to disturbed internal secretions, as the nervous lesions associated with rheumatoid arthritis are characterised by lowered nervous tone, and it is just this condition of lowered nervous depression which would be likely to favour those disturbed internal secretions which are associated with grave nutritional changes in the system.

Reviewing these several theories there is a decided lack of agreement concerning any one of them. There are certain phenomena of the disease which indicate some participation on the part of the nervous

system and yet there are other peculiar characteristics which are indicative of some infective or tonic condition. The infective theory requires the support of the neural theory to explain certain characteristics while the purely nervous theory is unable to explain certain features without the aid of the infective theory. The overlapping of these two theories is due to the clinical expression of the disease, and it seems to justify the disease, in claiming a kinship with a genesis which provides the influence on the nervous system and at the same time so simulates an infection.

The want of unanimity concerning the organism, the varieties of the organisms, the lack of results from inoculation are detrimental to the infective theory. On the other hand, the most ardent supporters of the neural theory have been unable to point out any definite lesion in the nervous system, the symmetrical manner in which the disease begins is also against this theory, as it usually affects the joints of one hand then the joints of the other hand and no lesion has been demonstrated in the cells of the anterior cornua of the spinal cord.

Premonitory Symptoms, and Modes of Onset.

It is all important to appreciate the true nature of the disease as once the clinical picture has so far advanced as to leave no doubt there is little

prospect of a satisfactory prognosis and whatever prospect there is of treatment, it is seriously hampered by the intractability of the disease.

Vasomotor Phenomena. Sweating confined to some one area such as the hands and feet. The skin over the hands and feet may be cold, blue and clammy. Spender describes three varieties of cold hands in the disease.

1. The cold dry hand uninfluenced by atmospheric conditions.

2. The cold hand except on the palms where the perspiration streams down the natural furrows.

3. The hand cold and wet all over, the dew is always present and uninfluenced by atmospheric conditions, the feet are likewise affected, and if the feet of a patient in bed are exposed, drops of perspiration can be seen on the soles.

Sensory disturbances such as tingling, numbness, hyperaesthesia, pain of a burning character are sometimes experienced in the upper and lower limbs, or a sensation of cold water or air passing down the spine. The arms may be thrown outside the bed-clothes on account of the uncomfortable sensation of burning.

Spender lays great stress on a disseminated form of pigmentation, and may occur in various places and of irregular shape, or as a general darkening of the complexion, most marked on exposed parts, or more or less widely spread patches, like freckles or splashes

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of paint.

This pigmentation is present in a large number of cases but whether it is peculiar to rheumatoid arthritis is doubtful, as pigmentation occurs in many chronic affections especially those associated with failure of nutrition, also in apparently healthy people.

Pain.

The patient may awake in the night with a feeling of pain in the ball of the thumb, the hand may be unable to grasp things and the patient thinks she is paralysed.

The pain may be severe and persistent lasting for several hours, and worse at night. Sharp crampy pains in the muscles are also met with or sudden pains may run from the ends of the fingers up the arm. The pains are less severe during the day, but the joints may feel stiff in the morning or after a day of unusual exercise.

The temperature is usually normal but an evening rise of a degree or two is common. The pulse also varies in most cases being accelerated. Dyce Duckworth and Spender attach great importance to this hastened state of the pulse.

Very frequently the initial joint symptoms are attributed to some slight accident, such as a sprain of the wrist, ankle or thumb.

With the onset of the pains a swelling of slow growth appears in the menaced joint. The joint (of the wrist) is bulged and tender and can be well seen when viewed laterally and is accompanied by a cracklingsensation although the cracking may be present without the swelling, later in the disease this crackling gives place to a sensation of grating in the affected joint.

Articulations.

The joints most frequently attacked are those on which the maximum amount of strain is put, namely the small joints of the fingers, the metacarpal phalangeal and the wrist joint, the knees and ankles, and there is a tendency for the disease to start in the peripheral joints and spread to those nearer the trunk, first affecting the upper limb then the lower, the lesions ultimately becoming symmetrical. The skin over the joint has a dusky red tint at first which later presents a shiny glossy appearance, and in the large joints excess of fluid may be present giving a tense elastic feeling when no fluid is apparent the joint feels doughy from thickening of the capsule and any attempt at movement is resisted. On account of the pain which is caused. The disease may progress with appalling rapidity one joint after another being quickly involved till the patient becomes a helpless cripple, unable to walk, stand, or

feed herself and with joints fixed and useless or the course of the disease may be more insidious, which is the more usual, and for years after the nature of the disease has been recognised the patient is able to have a fairly comfortable existence complaining at times of the pains, of the stiffness of the joints and of the deformities or disfigurement of the joints. The activity of the disease varies at times in each patient, sometimes a fairly quiescent stage is reached which may last for weeks or months, others being very active, and conditions which affect the general health seem to have an aggravating effect.

Again in some cases particularly in aged patients no complaint is made of the pain though the hands show to a typical degree the bony changes and are markedly deformed. Such patients have usually laboured hard and Lane describes these characteristics as "Traumatic or Mechanical Arthritis." The joints first affected by the disease are usually the metacarpal phalangeal joints of the first and second fingers. The interphalangeal joints of the fingers swell and the enlargement produced is fusiform or spindle shaped.

The thumbs usually escape, yet their carpo-metacarpal joints may be involved. The wrist next becomes affected, then the foot, but often the knee, afterwards the shoulder and then the hip.

This is the usual sequence but there are many exceptions as the disease may be limited to the hands, or the knees for a life-time.

An important diagnostic point is the involvement of the temporo-maxillary joint, one which is seldom affected in rheumatic conditions.

Involvement of the intervertebral joints occurs, especially of the occipito-atloid joint resulting in stiffness and definite limitation of nodding or rotatory movements of the head.

The symmetrical arrangement of the affected joints is characteristic of the disease, but by no means invariable as the joints of one side of the body may show advanced changes while those of the other side are only slightly affected.

Charcot states that the lesions tend to advance up the limbs towards the trunk but although the wrists are generally affected after the fingers, and the ankles after the feet not seldom are the tarsal and carpal articulations affected first. The elbow often escapes while the shoulder is involved, in the lower limb the knee seldom escapes. The temporo-maxillary joint may become stiff and painful at any early stage but it is only attacked in about a quarter of the total number of cases.

Forsbrook gives the following table of centripetal extensions.

Joints affected.	Total.	Percentage.
Hands and Feet.	430.	86.0
Knees.	303	60.6
Feet.	172	34.4
Ankles.	137	27.4
Wrists.	133	26.6
Shoulder.	125	25.0
Elbow.	125	25.0
Hip.	73.	14.6

This symmetrical arrangement is more apparent in the earlier and more rapidly progressive cases, in those in which the disease is less active there is a tendency for it to remain localised in a few joints. Once the changes have begun there is no tendency towards recovery in the joint, and it becomes the seat of a gradual progressive disorganisation unless arrested by treatment.

Clinical Cases.

Case I. B.W. aet. 48, cook. Her illness began with pain in her finger joints while pursuing her avocation in domestic service.

Family History. Father and mother alive, no history of any illness.

Previous History. Nil, no internal trouble.

General History. About seven years ago the patient felt pain in the middle joint of her third finger of right hand, in a short time the same joint in the same finger of left hand became painful, then the first finger of right hand, then first finger of left. At this stage her condition was diagnosed as being rheumatoid arthritis and she was advised to go home, but she persisted in her work until the right elbow joint became affected, and later the left, at the time she felt very severe pain in the temporo-maxillary joint and she was unable to get a teaspoon into her mouth. The pain next started in the arch of her right foot and she used iron instep soles for support. At this stage she left service and came home. The joints of the fingers were swollen to such an extent as to enable her to put the tip of a finger between the bones. She called the condition 'double-jointed.'

Present Condition. The woman is of good

physique. She has no use of her legs, and cannot move them. Her hands and arms are also useless. She spends her time when out of bed in a wheeled chair having to be pushed about.

The pains in her joints are occasionally troublesome and she suffers at times from derangement of stomach and loss of appetite.

On Inspection.

The metacarpal phalangeal joints of both hands are much swollen being hard and dense, the slightest movement or touch producing pain.

The interphalangeal joints show great thickening and give an appearance of a spindle and are incapable of movement.

The fingers of both hands are deflected towards the ulnar side to a very great extent.

No nodosities are seen or felt. The muscles of the forearm are greatly atrophied, as are also the interossei. The elbow joints are ankylosed in a position midway between flexion and extension and all movement takes place at the shoulder joint which is very slight.

Knee joints. The knee joints are semi-flexed, on palpation the condyles of the femur cannot be made out, neither can the heads of tibia and fibula, the joint presenting an ovoid appearance, hard to the palpating finger. The patella can be felt in its normal

position, but immovable, and at the sides it shelves off into the general mass of consolidation.

The aspect of the knee looks greatly enlarged which probably is accentuated by the wasting and atrophy of the muscles above and below the joint.

Sensory Symptoms. She has occasional flushes of heat and cold lasting a few minutes after which she feels very weak.

She has noticed that the pains are often severe during cold and wet weather.

Case II. M.G. aet. 67, a needlewoman, complains of pains in all her joints.

History of Illness. Six years ago she felt a pain in her right thumb and forefinger and so intense she had to cease working and was treated for 'needle cramp' but the pain increased and attacked the joints of left hand, then her right became affected, a few months later her shoulders became painful and on movement a peculiar crackling noise was emitted, subsequently her knees became affected.

(This patient's was not so intelligent as the preceding and could not give exact dates for her symptoms.)

Family History. Father a quarryman died of gangrene of toe the result of an accident. Mother died of liver trouble(?).

Previous Illness. Nothing of note, except

urticaria some years ago.

Present History. The patient is a feeble old woman confined to bed for the past year, previous to this date she was capable of getting out of bed and walking with the help of a stock. The fingers of both hands show much thickening at the middle joints and also at the meta-carpal phalangeal joints.

Ulnar deflection of the hands is well marked. The muscles of the thenar eminence are very much atrophied, as are also the inbrossei and muscles of fore and upper arm. The skin of the hands and arm is loose and in small folds denoting a loss of subcutaneous tissue and the colour is of a yellow in tinge, with numerous dark brown spots like freckles. Immediately over the affected joints the skin is shiny or glossy, as if drawn tightly or stretched. The knee joints are fixed and have practically disappeared, their place being taken by an ovoid mass. The muscles of the thigh and leg are atrophied. The skin of the lower limb being loose as in the the upper limb and of the same yellow tinge.

On several occasions she has had severe pain in the temporo maxillary joint, and been unable to open her mouth, but this usually passed off in 24 hours leaving no permanent disablement. She has suffered from severe pain in her neck and unable to move it laterally, and only very slightly in an antero-

posterior direction.

A peculiar feature marked in this case was the shining, glazed appearance of the skin of her forehead, just as if it were enamelled.

The vasomotor phenomena were similar to Case I. and the burning sensation in the hands so intense at times she had to put them outside the bedclothes.

She has periodic sweatings of the hands and of the feet on removing the bedclothes feel damp.

Case III. Mrs. R. aet. 51 years, married. housekeeper, complains of pains in the hands and knees.

Family History. Father died of cardiac disease. Mother died of some rheumatic trouble.

Previous History. The woman has never suffered from any disease, was always healthy. Her surroundings being good, having a comfortable home. Habits temperate. Has had four children.

Present History. Pains in both knees, which are stiff and on movement emit a crackling noise. The right knee is swollen and very tender to the touch. The fingers at the middle phalangeal joints are much swollen and spindle-shaped, and ulnar deflection of the hands is well marked. The patient is anaemic and the skin of a yellowish colour.

A feature of this case is the history of rheumatic trouble in one of the parents.

Case IV. W.M. aet. 61, female, washerwoman.

complains of a feeling of pins and needles in her hands and feet at times and pains in her joints.

Family History. Good, no disease.

Previous History. The patient was an only child and never much exposed to cold or damp. Menopause at 48 years. Shortly afterwards she felt pain in her left elbow and hand which was associated with swelling. A month later the pain was felt in the right elbow and hand. There were no further developments for a period of six months, except that during this interval the pain varied in site and intensity from day to day, sometimes in the right arm sometimes in the left. After the lapse of six months she felt pains in her ankles, these became swollen and tender. Three years later her knees became affected.

Present Time. The patient is a healthy woman of good physique for her age.

She walks with great difficulty by means of a stick, her movements being shuffling in character. The fingers of both hands are deflected towards the ulnar side and are much thickened at the metacarpal-phalangeal joints and also at the inter-phalangeal joints. The fingers are in a position of semi flexion and her hands feel damp and cold. The muscles of the thenar and hypothenar eminences are greatly atrophied, as are also the interossei muscles.

The elbow joints appear enlarged, owing to the atrophy of the muscles above and below the joints,

they are in a position halfway between flexion and extension and movement is very slight, as the movement seems to take place at the shoulder joints.

The knee joints are much enlarged, no bony prominences being made out, they are ovoid in shape, movement being very limited and accompanied by a grating sound.

The muscles of the whole lower limbs are much atrophied, and the skin loose showing great loss of subcutaneous tissue. At the same time being greatly stretched and shining over the joints.

The knee jerks are exaggerated.

Other Systems, nil.

Case V. Mrs. B. aet. 64, housewife.

General appearance. Patient is a tall very spare woman with a full face. She has always been thin and somewhat anaemic.

History. General; she has never been very robust, and of late years she has been rather weak at all times, frequently being confined to bed for several days. There has been practically continuous constipation for years, and she gives a history of pains in her back, sides and limbs of long standing. No definite rheumatic attacks are remembered and no disease to note.

Present Condition. On 17th April, 1908, she had some twinges of "rheumatic" pains between the

scapulae. The pains left this region suddenly, and in her own words, "seemed to run down the right arm and to settle in the wrist joint." That same evening she observed a swelling over the wrist joint which would 'pit' on pressure. The power of opposition of the thumbs was lost (is now regained) and she had difficulty in making movements with the hands; her right hand being practically useless. Two months later the left hand was attacked. The left thumb became swollen at its base and painful, this she thought was a sprain or strein due to over-use of the left hand for the two months during which the right hand was incapacitated.

There was considerable swelling over the thumb and around the wrist, and back of the hand. She also noticed a soft swelling about the size of a pigeon's egg at the side of the wrist joint.

Condition of Hands.

Subjective Symptoms. She feels a creaking sort of feeling on making movement at the wrist joint, especially twisting movements or on rotatory movements of the wrist when the ulna and radius are fixed. In the right hand there is not much pain on movement at the present time, though three months ago considerable pain was produced by passive movement, and on pressing the fixed carpus against the fixed ulna and radius the pain was intense.

Objective Examination.

Right Hand. There is swelling present over the back of this hand, and also over the region immediately proximal to the thenar eminence. There is some swelling over the region of the anterior annular ligament. Over the lower end of the ulna there is a small swelling about the size of a walnut, like a bursa.

The muscles of both the thenar and hypothenar eminences are atrophied.

The lower end of the ulna is enlarged, as is also the styloid process and it is over this enlargement that the above mentioned bursae swelling is situated.

The pisiform bone is almost fixed.

Great creaking is elicited by making passive movements at the joints and especially at the carpo-metacarpal joints.

The fingers of the hand are deflected towards the ulnar side.

Left Hand. The condition of the left hand is much the same as right, but two months more recent.

Creaking is felt all over and is more marked. Pain is elicited on making pressure over the carpo-metacarpal joints.

Similar wasting of the thenar and hypothenar eminences is present as in the right hand, the ulna and styloid process being similarly affected. The

fingers cannot be flexed without much pain and are deflected towards the ulnar side.

Case VI. D.R. aet. 57, male, complaining of stiffness and pains in his joints.

The patient is an intelligent man and has followed the development of his condition with great care. Occupation in early life an outdoor labourer, later a crofter.

Previous History. No history of previous illness in the family. Parents died of senile decay.

Patient's History. Twelve years ago he felt pain in the soles of his feet, a few months later the left knee became stiff and painful as also the fingers. At a later date the right knee and wrists and elbows.

Four years ago began to have difficulty in walking and on movement of the shoulders a creaking noise was heard, and at this time the pain was intense in the side of the neck causing it to become stiff. A creaking noise was to be heard on movement of the lower jaw at the temporo-maxillary articulation.

Present Condition. The skin of the hands is soft and clammy and no creases are to be seen. The wrist joints are very stiff and the meta-carpal-phalangeal joints are greatly thickened. The fingers are semi-flexed at this joint and show ulnar deflection.

The elbows are rigid and semi-flexed and on palpation a hard dense ring of tissue is felt around

the joint.

The shoulder joints appear enlarged, and movement is limited to a forward and backward motion. No movement of circumduction can be performed. There is great atrophy of the muscles of upper and lower arm, also of the thenar and hypothenar eminences and interosseal muscles.

The knees are one consolidated ovoid mass, none of the bony prominences being made out.

General. Enjoys a fairly comfortable existence except periodic attacks of pain which he states come on during cold and foggy weather. He is much troubled with burning sensations in his hands, although to the touch they feel cold and look blue. His feet perspire greatly.

Case VII. I.P. aet. 49, labourer, complaining of pains in all his joints.

Family History. Not much known; father subject to intemperance.

Patient is a strong big-framed man but much reduced by intemperance, hardship and exposure.

Present Condition. The wrists of both hands are convex in shape on their dorsal surfaces, that is, the hands are partially flexed at the wrist joints. The phalangeal joints are all fully extended or hyperextended with the exception of the terminal phalanges which are partially flexed. The thumbs are closely

adducted to the first fingers, the terminal phalanges being hyperextended, producing a concave appearance dorsally on viewing the thumbs laterally.

The lower extremities of the bones of the lower arm are enlarged and a ring of thickening is felt around them.

The middle joints of the fingers are in a state of extreme extension and incapable of movement either actively or passively.

Both hands are much emaciated, and deflected towards the ulnar side at the meta-carpal phalangeal joints.

The shoulder joints. A ring of dense out-growths can be felt around these joints, and on movement a peculiar grating noise is heard.

The knees are in a position of semi-flexion with much thickening around them which is especially well marked on the internal and external aspects of the joints.

The muscles of the hand are greatly atrophied as are also the muscles of the arms while the legs have a skeletal appearance so great is the wasting of the muscles.

General History. Complains of feeling cold, even while in bed and during the summer months.

Case VIII. M.S. aet. 47, married; seven children; complains of rheumatic pains which commenced

in hands nine years ago and gradually extended to all her joints.

Previous History. Has always had good health; had two miscarriages, but no ovarian or uterine trouble.

Family History. Patient states her mother had 'rheumatics' and that her hands were twisted. Father died result of an accident; one brother and one sister subject to bronchitis.

Present Conditions. Both hands are affected and the muscles of the thenar and hypothenar eminences are much atrophied. The fingers are flexed at the metacarpal-phalangeal joints and on palpation some thickening is felt in the dorsal surface of the joints, the middle phalanges of the index and middle fingers are extended in both hands; the same joint in ring and little fingers show some flexion particularly in the left hand. There is well marked ulnar deflection. The thumbs show well marked lipping at the metacarpal phalangeal joints.

The condition of the hands is associated with the usual atrophy of the muscles of thenar and hypothenar eminences.

The elbow joints are not so much involved and there is a good range of movement. Crackling can be elicited, yet flexion and extension can be performed easily. The other joints are freely movable and no discomfort is experienced except previous to cold and

wet weather when they are extremely painful.

Case IX. R.A. aet. 78, female, was an outdoor worker and the history is of rheumatic pains in her joints for 20 years.

Present History. The woman ~~has~~ been confined to bed for the past ten years and she is unable to give an account of her illness owing to her mind being weak. She takes no notice of anything, seldom complains except when she is moved or when her back is dressed for bedsores.

Present Condition. The patient's body is much emaciated and shrunken, the skin being very much wrinkled; she lies curled up in the bed, the legs half drawn up and flexed at the knees. Her arms are flexed at the elbow joints and lie across her chest with the palmar surface of the hands in contact with the chest. Her head is usually immobile and bent towards the left side and she moves it with difficulty.

The knees have an enlarged appearance partly owing to the ovoid shape and also to the wasting of the muscles above and below the joints, all the bony prominences have become merged into a solid ovoid mass.

The elbow joints are ankylosed and there is also marked atrophy of the muscles. The wrist joints are arched and immovable, the metacarpal bones are in a parallel line with those of the lower arm, the extensor tendons being very prominent. The heads of

the metacarpal bones are enlarged and are dense and hard.

The fingers are flexed at the metacarpal phalangeal joints and some thickening around the middle phalangeal joints the terminal phalanges are somewhat extended.

Both hands show marked ulnar deflection and there is great wasting of the thenar and hypothenar eminences.

The patient seldom complains unless when moved. She is of a very irritable disposition and also emotional.

She is greatly troubled with constipation requiring aperient medicine constantly. She has had two attacks of cystitis. The symmetrical affection of the joints is well exemplified in the afore described cases, the disease attacking a certain joint in one limb and next the same joint in the other limb, it may be a knee joint, or elbow joint, or finger joint. At the same time the frequency with which the finger joints are first attacked is remarkable and the disease seems to have a predilection for these joints, those where the finer and more delicate movements of the body take place, and which have been most actively engaged in the specific craft of the patient, whether it be husbandry, needlework or washing, these are usually the first to show signs of arthritic de-

generation.

The capacities of the human hand are so many and varied that unequal strain may be placed upon it even in people not engaged in manual labour and if the smaller joints of the wrists and fingers are represented as one joint **split** into segments for a special function it is evident that the risks of rheumatoid arthritis disease is multiplied. Similarly with the foot and toes.

The feet may enjoy comparative rest and repose but the movements of the hands are essential in ministering to the affairs of life participating in that restless energy which constantly goes on, except during sleep. Consequently the physical wear and tear is an inevitable result.

Also the higher endowments of the hand imply a correspondingly higher level of brain and nervous development and organization and the complex motor and sensory apparatus of the upper limb has a physiological connection to make between the two, and this very high state of development and complexity may make it more vulnerable to disease.

The joint assumes the shape of a more or less symmetrical spindle, it is swollen, and its normal shape obscured, the bony landmarks being made out with difficulty, the impression received on examination is that the soft parts in the joint are thickened or the



enlargement of the joint may be nodular and irregular, the bony landmarks being more accentuated, lipping of the articular surface may be felt along with definite osteophytic outgrowths.

The articular changes in the joints are invariably associated with more or less atrophy of the muscles of the limb in some cases being extreme adding greatly to the deformity which results. The extensors of the joints suffer more than the flexor muscles. In the hand the interossei suffer especially the dorsal interossei. The thenar and hypothenar eminences do not escape and participate to a great extent in the atrophy, the general wasting in a limb may be so decided as to simulate the changes in progressive muscular atrophy.

The reaction of degeneration is usually absent yet the wasting of the muscles bears no proportion to the degree of the involvement of the joint, it may be more marked when the joint changes are slight or moderate, but this is not usual, rather the reverse order, the joint changes being advanced or well established before the atrophy of the muscles takes place. The tendon reflexes are often increased, but not invariably.

The Deformities.

In the hands a common and early change is ulnar deflection at the metacarpophalangeal joints.

At first the deflection is slight and may be corrected, but later it becomes extreme and only partially, if at all, reducible.

The phalanges may be flexed or extended on each other, or upon the metacarpal bones. In advanced cases the knee joints are almost invariably flexed, the ankle joint frequently fixed, the foot abducted and the great toe deflected to the outer side.

The temporo-maxillary joint may be ankylosed and the patient unable to masticate food. The head may be fixed either in a natural position, or in a position of flexion or rotation from changes in the cervical vertebrae.

The disease besides being symmetrical in its distribution is also symmetrical in the deformity it produces, one affected joint being the exact picture of another, and Sir Thomas Watson states, the deformity is symmetrical, one crooked joint is just the copy of its fellow.

Causes of the Deformities.

I. From ankylosis or partial ankylosis of the joints, or changes in the form of the articular surfaces.

II. Atrophy of certain groups of muscles, and increased tonicity or spasm of others thereby producing a disturbance of the normal relations of one muscle group to another, and in extreme cases producing ac-

tual dislocation of the bones which may be partial or complete.

III. Changes in the ligaments and tendons about the joint, commonly in the direction of increased laxity or destruction, the increased laxity may be due to displacement of the tendon by the spindle-shaped swelling of the joint.

IV. The effect of gravity and the habitual position of the limb.

V. The thickening of the capsular ligament of the joint is increased by osteophytic growths, the tendons of the muscles becoming stretched and thinned.

VI. Periarticular bony formation may cause entire dislocation of a joint and force it into an abnormal position, or render it immovable. When contraction of the dorsal interossei produces flexion at the metacarpal-phalangeal joints, the first phalanges tend to become hyper-extended and there is a compensatory-flexion of the terminal phalanges and when there is a hyper extension at the metacarpal phalangeal joints the condition is reversed.

Diagnosis.

In the early stages of the disease a diagnosis is a matter of extreme difficulty owing to the onset of the disease being so insidious; and the want of definite and distinct symptoms of the disease, the diagnosis is based on symptoms taken collectively not

as can be assumed in many cases on an individual symptom. It therefore requires a minute examination into the history of the patient, and of the clinical evidence of the disease.

An early diagnosis is very essential and especially to distinguish the disease from rheumatism and rheumatic affections, as the line of treatment is quite at variance between these conditions. The sensory disturbances such as tingling and numbness occurring in a woman of middle age are often put down as a hysterical manifestation. The pains in the fingers often attributed to some form of cramp brought on by occupation. The palpitation of the heart is also thought to be a neurosis and it is only when the enlargement of a joint or rather of the joints takes place that a rheumatic origin is suspected and even then a definite diagnosis is not made as the error is in thinking the condition rheumatic and treatment being undertaken on this line, thus valuable time is lost.

A limitation of movement and a crackling or grating sound when the ends of the bones are rubbed against each other are proofs that the mechanism of the joint has gone wrong.

Kent Spindler in the Lancet, 1892, states that the primary affection may not be arthritic at all, there might be an unusual force and frequency of the

heart-beat, the skin might present patches of pigmentation, there may be irregular, profuse sweatings and little might be complained of about the joints.

Dr. William Ord on January 31st, 1880, giving an address on rheumatoid arthritis states -

The painful, swollen, hardened, knolled and in various degrees stiffened, or partially dislocated joints standing in contrast with the unaffected shafts of the limbs and unaccompanied by tophaceous deposits form when their chronic and progressive history is learned the first means of identification. The disease is a polyarticular affection and as pointed out, occurs most frequently in women. The smaller joints are usually those first attacked and its centripetal extension with a tendency to symmetry is very diagnostic.

- The skin over the affected joints is pale and white, and glossy. The cold clammy hands with periodic sweatings of hands and feet. The peculiar sensations of pins and needles prickling and numbness, the feeling of something passing over the head or down the back. The quickened pulse rate, and the small rise of temperature, these symptoms taken collectively present a picture in the early stages of rheumatoid arthritis which cannot be overlooked.

In the later stages there are the thickening of the structures around the joints, its fusiform or

spindle shape, the involvement of the temporo-maxillary joint, the wasting of the muscles particularly the interossei and those of the thenar and hypothenar eminences.

In the advanced stages the changes produced are typical; the deformed and unshapen joints, the ulnar deflection of the hands, the thickening of the metacarpal phalangeal and other affected joints, the advanced atrophy of the muscles and the symmetrical and centripetal extension of the affection along with the skin changes and vasomotor phenomena and the persistent nature of the joint swellings are conclusive evidence of the disease being rheumatoid arthritis.

Differential Diagnosis.

The diseases most likely to be confounded with rheumatoid arthritis are acute rheumatism, gout, gonorrhoeal rheumatism, progressive muscular atrophy, haemophilia.

From Acute Rheumatism.

Acute rheumatism more common in males.

Rheumatoid arthritis in females.

The temperature is as a rule higher than in rheumatoid arthritis.

Profuse sweats common, not localised as in rheumatoid arthritis.

The large joints are affected instead of those of the hands and fingers in rheumatoid arthritis.

The affected joints recover completely and no residual thickening remains as in rheumatoid arthritis. The skin over the affected joints is reddened in contrast to the pale glossy skin of rheumatoid arthritis. The temporo-maxillary joint is rarely affected; there is no wasting of muscles and if it occurs is late of starting.

The pulse is accelerated and cardiac complications are common; rare in rheumatoid arthritis.

Acute rheumatism responds to treatment by salicylate of sodium. Rheumatoid arthritis does not.
From Gonorrhoeal Arthritis.

The temperature has an intermittent character in gonorrhoeal arthritis; there is a history of vaginal or urethral discharge, also the occurrence of iritis or conjunctivitis. The limitation of the disease to the larger joints especially the knee joints.

From Chronic Rheumatism.

Lane writing on the diagnosis of rheumatoid arthritis in 1890 states.

"Let us imagine two patients sitting side by side, one with rheumatoid arthritis and the other chronic rheumatism.

In the rheumatoid arthritis case the first thing noticed is the pallor of the patient as compared with the chronic rheumatism. The next thing is the

joints; the rheumatoid arthritis is crippled more or less whereas the chronic rheumatism presents little or nothing. There will be a distinct muscular atrophy in the rheumatoid arthritis and the complexion will show on close observation yellowish tinges on the face, and neck and perhaps elsewhere. The family history of the chronic rheumatism will be good whereas the rheumatoid arthritis in most cases gives a strumous taint which is of assistance in guiding the treatment of this creeping malady."

From Gout.

Have the family history and also the typical form of attack or a history of intemperance, patient usually of the better class, and more common in men, and hereditary. Have uric acid in the blood which can be tested for by means of Garrod's experiment which consists in obtaining a drachm of blood serum from the patient and adding two or three minims of glacial acetic acid and placing a worsted thread in the mixture for 30 or 40 hours when uric acid and stabs should be found on the worsted.

Have also uric acid in the urine and demonstrated by the murexide test, or the typical resemblance to grains of cayenne papper can be seen.

The tissues of the joints which have been subjected to gouty inflammation always exhibit deposits of uric acid in the form of biurate of sodium.

Gout is often manifested in the skin, throat, kidneys, bladder and digestive organs. In gout have the great toe selected as the starting point.

In Rheumatoid arthritis.

There is absence of excess of uric acid in the blood, and no biurate of sodium in the joints or near them. There is marked alteration in the cartilage by ulceration from the very first and in no time the bones become denuded.

At present there is no relation between the skin, kidneys and digestive organs. No family history except debilitation. Commonest in women. The effects of diet not marked in the production of the disease.

From Haemophilia.

In this have the history (family) and also of severe haemorrhages from trivial abrasions. The haemorrhage occurs into the joint cavity and it is swollen and painful especially on movement and the overlying skin is often discoloured. The onset of the swelling is often sudden and accompanied by a rise of temperature.

In a few weeks the swelling disappears but has a tendency to return.

From Progressive Muscular Atrophy.

Garrod states that when atrophy of the upper limb is an early symptom of rheumatoid arthritis it

might be confounded with progressive muscular atrophy and the essential point which distinguishes these diseases lies in the presence or absence of sensory phenomena often real and impressive in the rheumatic lesion, startling in their intensity and disturbance to the health by their duration.

Progressive muscular atrophy is more frequent in males than females.

The reflexes are greatly increased and a jaw clonus can be obtained. On starting to walk the patient seems glued to the ground and makes ineffectual attempts to lift the toes; then four or five short quick steps are taken on the toes with the body thrown forward and finally he starts off, sometimes with great rapidity (Osler).

Prognosis.

The prognosis of rheumatoid arthritis will vary according to whether the disease is in its early stage or in an advanced condition, and in the former period much will depend on the promptness with which the true nature of the disease is recognised.

The prognosis is worse when the disease attacks the two extremes of life as its course is invariably progressive until decrepitude occurs. Yet there are exceptions and these should be an encouragement to combat the disease to the full extent.

In the early stage it is possible to arrest

the progress of the disease and its extension to other articulations, but nothing can be done to restore the disorganized joint to its former state of efficiency.

The prognosis also depends on the patient's station in life, whether he can obtain the generous nourishment which is required, his freedom from extremes of damp and cold and also mental worry and care, in other words the prognosis is better in a person in comfortable circumstances than in the lower classes.

In the advanced stage very little can be done save to make the patient as comfortable as possible, to ease the pains and counteract the deformity as much as possible.

Whichever stage the disease is in it is essential to maintain a cheerful attitude in the presence of the patient and all depressing influences and environments should be avoided; perhaps the best plan to avoid this mental lassitude of the patient is to divert the mind and encourage the taking up of some hobby which will vary according to the individual tastes and capability and thus relieve her of the feeling of dependence so galling to one of still active mind and energetic disposition. Death usually occurs from some intercurrent disease such as phthisis, and renal affections. Cystitis is very common and apt to occur in weak debilitated old people who are

bedridden.

Cerebral haemorrhage is a frequent cause of death; also bedsores and phlegmon.

Treatment of Rheumatoid Arthritis.

Fundamental Principles. Hyde in the "Causes and Treatment of Rheumatoid Arthritis" states that, "before entering on the general treatment there is no disease in which patience and perseverance in a given course of treatment are more necessary for success; many weeks and often several months must elapse before the disease shows decisive signs of yielding to the treatment adopted, and then it may be that for two or three or more years the general measures must be continued incessantly and the special measures recurred to at periodical intervals, before the patient attains that degree of restored health which is rendered by such means more than possible.

Again rheumatoid arthritis being essentially a disease of mal-nutrition of the joint structures and also of general debility, and attended with atrophy of bone, cartilage, skin, subcutaneous and muscular structures, it is clear that a depressing mode of treatment is to be avoided and that all treatment must be directed towards the improvement of the nutritive processes.

Again, the necessity of the patient being in as good a physical state as possible and the elimination or removal of anything which has a negative effect, such as any chronic condition of the teeth, ear,

nose or throat; in women, the occurrence of endocervicitis, or metritis and vaginitis, in men the urine should be centrifugalised and examined for pus which may lead to the detection of some genito-urinary lesion. Attention should be directed to the state of the digestion to dilatation of the stomach, and to constipation.

The following are the modes of treatment.

1. Diet and Hygiene.
 2. Climatic treatment.
 3. Bath.
 4. Drugs.
 5. External and local applications.
 6. Surgical treatment.
 7. Vaccine treatment.
1. Diet and Hygiene.
 - a. Diet.

The question of diet is a most important one, for whilst a suitable diet helps materially in resisting the disease yet needless restrictions tend to favour its progress and extension and because of the resemblance to gout a dietary recommended for this class of patient has often been recommended for patients with rheumatoid arthritis; this line of dietary has not been given up as it has been found that sufferers from rheumatoid arthritis are greatly benefited by a more than usually nutritious dietary rich in nitrogenous and fatty constituents. As meat is

the most easily assimilated form of nitrogenous food, two meals a day should be given, and if the teeth are defective or the digestion impaired the meat should be minced; where two meals of meat cannot be taken it may be preferable to try adding a chop or steak to the ordinary diet.

When meat is not tolerated Plasmon or Sanatogen and milk make efficient substitutes.

Fat is best given as milk and cream and the patient should be directed to drink half a pint of milk two or three times a day and to keep some warmed milk food at the bedside to be taken in the night if wakeful. A thermos flask will be found very convenient for this purpose. Fat can also be taken as cream with fruit, or as bacon, or in an increased quantity of butter. In cases where the temporo-maxillary joint is involved great difficulty may be experienced in feeding when the teeth and jaws cannot be separated and the difficulty is twofold, one the act of feeding and the other mastication being impaired or impossible. To obviate the first recourse may be had to a stomach tube, the tube being passed over a broken tooth, or a nasal tube may be used.

To overcome the second difficulty meat juices or extracts must be given in small quantities at a time. If these methods fail recourse must be had to rectal feeding by means of nutrient enemata.

A variation of the meat diet is essential, and poultry, game, lamb, mutton, fat bacon, and ham, may be given; also fish of all sorts.

Vegetables. No restrictions may be placed on the patient regarding vegetables as to quality or quantity, always bearing in mind the capability and idiosyncrasy of the patient.

Alcoholic beverages.

In the majority of cases these are not essential, but a moderate supply of alcohol is useful in some cases. Wines are more beneficial than spirits and porter or stout is even more beneficial.

Hygiene.

Clothing. The clothing of patients suffering from rheumatoid arthritis is very important. Too heavy clothing is not desirable. The patient should wear light woollen under garments next to the skin and these should be changed regularly, at the very least once a week and oftener if the patient suffers from sweating. A layer of thick brown paper with a hole cut to allow the head through and falling over the chest and back is as useful as two or three flannels. The use of shoes should be prohibited because of the lack of support to the ankles. Well made boots properly fitting and not too heavy with porous cork soles are to be recommended. Stockings should be thick and double knitted soles are advantageous.

Climate.

A warm dry climate with a porous soil and as equable a temperature as possible is the best, as sudden fluctuations of temperature increase the arthritic pains. If the patient's home is in a wet, damp and misty district, removal to a drier locality should be urged. If the patient ~~is~~ well to do she should be sent to a warmer climate than our islands, along the shores of the Mediterranean, but this is only applicable in the early stages before crippling has set in as she is then unable to stand the fatigue and discomforts of a long journey. If she remains in England it is advisable to keep her inland and away from the sea coast, and in the summer months benefit is to be obtained by a stay at one of the more bracing British inland watering places. Buxton, Harrogate, Strachpeffer, etc.

Exercise.

It is very important to get rheumatoid arthritis patients out of bed as early as possible and encouraged in every way to use their joints as otherwise they become stiff, and unless contraindicated by the pyrexia or some other complication regular exercise should be insisted upon proportionate to the strength and power of the case. Stiffness and rigidity of the fingers may be overcome by piano-playing and knitting and other similar exercises.

The movements of the shoulders can be improved by a modified use of Sandow's developer. When the patient is unable to walk she must be taken out in a Bath chair or similar conveyance so that she may gain all the benefits and advantages to be derived from fresh air, sunshine, and change of surroundings thus improving the mental as well as the physical condition; in such patients it is necessary to massage the joints and make passive movement of them.

Massage and Passive Movements.

Massage is employed in rheumatoid arthritis to promote the nutrition of the wasted muscles and to minimize the amount of contracture.

In the acute stage of the disease the joints must be left severely alone and the rubbings restricted to the chest or abdomen and as soon as possible the rubbings are to be concentrated on the wasted muscles, devoting a short time to general massage.

Passive movements are to be begun as soon as the joints can be manipulated without pain and continued regularly. Later the passive movements should be combined with resistance movements, and these measures should be carried on daily. Later the patient should be encouraged to make active movements and these should be made once or twice daily according to the strength of the patient.

All excess should be studiously avoided. Any-

thing that causes fatigue, exhaustion or excessive pain does harm instead of good.

Dr. A. Symons Eccles makes the following statement regarding massage -

"It is not unreasonable to believe that the inaction of muscles associated with a rheumatic joint induces the accumulation of waste products in the articulation itself and in its surroundings. The lymph-pumping function of the muscles normally acting on the joint is thrown into abeyance, and the influence of muscular contractions aiding the outflow of the venous current is lost. The intra-muscular arterioles, as also those of the skin, are contracted, and thus the blood supply to these structures is seriously interfered with, so that the washing out from the joint, and other structures of the morbid products accumulated therein is retarded, thus further increasing stasis in the inflamed foci. Inasmuch as most cases of chronic arthritis afford evidence of inflammatory deposits in the fibrous and muscular tissues connected with the joint, the lymph spaces of the connective tissue being clogged and matted together so that the movements of tendons and muscles are mechanically impeded, it is not surprising that after an attack of rheumatism the fibro-serous tissues are peculiarly liable to a recurrence of inflammation, especially if they are exposed to a repetition of the predisposing and exciting

causes."

Drugs.

At the present time there is no drug which exercises a special influence on rheumatoid arthritis such as that exercised by the salicylates in rheumatism or by colchicum in gout, and while the disease is not directly controlled by the action of drugs yet by a judicious use of them many of the distressing symptoms may be relieved, the general health may be improved thus increasing the resistance of the tissues. In the acute cases the remedies prescribed should be those calculated to relieve the febrile state such as quinine, phenacetin, salicine and aspirin, while being the drugs must used in the chronic form are iron, arsenic, iodide of potassium, guaiacum, sulphur and cod liver oil.

Llewellyn Jones advocates the use of quinine in one or other of its forms in acute phases of the disease. He prescribes the sulphate in 2 gr. doses in combination with dilute hydrobromic acid to prevent the headache which follows its administration, it may be taken every 4 hours or even oftener during the acuter stages and by gradually reducing its frequency to three times a day it may be continued throughout the more active periods of the disease, and when there is gastric irritability the salicylate of quinine with the salicylate of bismuth may be substituted. Should

pain and sleeplessness be prominent symptoms a cachet containing aspirin gr. V quinine sulphate gr. II, sodium bromide, gr. XV, should be given t.d.s. until these special troubles abate, when it should be withdrawn and a return made to the quinine and hydrobromic acid mixture.

Bannatyne considers guaiacoli carbonate as having a specific action in this disease, but Llewellyn Jones and Odery symes do not uphold this idea, the latter believes that it and other antiseptics act by controlling the excessive growth of bacteria in the stomach and intestines and thus lessening a toxic absorption which may be the exciting cause of the disease and whatever the explanation of the action of the drug may be there can be no doubt that many cases of rheumatoid arthritis accompanied with fermentative dyspepsia are much relieved by the administration of these antiseptics.

Arsenic was first used in the treatment of osteo arthritis by Dr. Jenkinson of Manchester in 1809 and Dr. Fuller advocates its use in cases which suffer greatly from cold and rarely perspire; it improves the appetite and digestion, the body weight increases, and the blood is enriched thus bringing back the patient's powers of resistance. It may be given as Fowler's solution or as arsenious acid in pill or cachet form.

Potassium Iodide. This has been very extensively used in cases in this country and great benefit is derived where pains in the joints were worse at night. The syrup of iodide of iron is very serviceable when combined with cod liver oil when there is emaciation and the appetite poor, the disadvantages of syrup of iodide of iron lies in the fact that it is apt to upset the digestion and patients very soon tire of its use.

Hyoscyamine has been found by Dr. A. E. Garród to be of great utility in the cases of painful muscular cramps to relieve the pain, phenacetin combined with caffeine, or antipyrin have a like effect but recourse may have to be had to chloral hydrate or morphia.

Llewellyn Jones states he has obtained good results from the use of thyroid gland in cases attended with marked vasomotor phenomena, such as coldness of the extremities. Of other drugs, strychnine, quinine, nux vomica, mineral acids and vegetable bitters are of great service from time to time to improve the appetite and general condition. Whatever medication is prescribed it is necessary to continue its use for months at a time. Constipation should be guarded against and oral sepsis, also intestinal putrefaction and hepatic sluggishness; to overcome these a mild laxative may be required such as compound liquorice powder, cascara, or a pill of nux vomica aloin and

belladonna for the hepatic conditions, calomel in $\frac{1}{2}$ gr.-1 gr. doses and phosphate of soda, Carlsbad or Sodium sulphate.

Local Treatment. Forsbrook states that when the joints are painful or swollen they may be either painted over with tincture of iodine, strapped with plaster or rubbed with belladonna liniment, but probably the use of hot fomentation is more useful, the joint being wrapped in a hot fomentation sprinkled with glycerine of belladonna. Jones thinks the use of cold compresses even more efficacious than hot fomentations. Relief is sometimes afforded by immobilising the painful joint, either by strapping or the use of a light splint but care should be taken not to keep the joint too long in splints without occasional massage and their use discarded as soon as possible.

A mixture of belladonna aconite and chloroform is a useful anodyne liniment when rubbed into the joint, a more stimulating liniment of turpentine, camphor and soap often acts very efficiently.

Counter Irritants.

For the relief of obstinate neuralgic pains the use of blisters is very effectual, and the liniments of iodine are strongly recommended.

Kent Spender advocates the painting of a ring of iodine liniment around the lower part of the thigh

two fingers breadth away from the knee, a similar ring can be painted below the knee, the ring to be one and a half inches wide and renewed every two or three days according to the delicacy of the skin, the great size of this blister is apt to produce more pain than the patient can suffer and numerous small blisters the size of a shilling are just as serviceable and produce less pain. Latham advocates continuous counter irritation over the section of the spine corresponding to the part involved and if necessary kept open by a dressing of unguentum safinae. Enveloping the joints in hot sand has been advocated by Haygarth and Trousseau.

Treatment by Hyperaemia.

Bier's method consists in the induction of passive hyperaemia by means of a rubber bandage. Before applying the bandage the limb should be enveloped in cotton wool to minimise the discomfort from direct pressure by the bandage.

The bandage should be wound round the limb with a tightness sufficient to retard the venous flow, but not to arrest the arterial supply to the limb. Bier advocates its use in rheumatoid arthritis and states it should be worn for 22 out of the 24 hours. It is essential that oedema should be produced and this should be reduced later by massage; this treatment relieves the pain in a few hours after applica-

tion and the analgesic effect continues for some weeks.

Ewert's treatment by interrupted circulation is something similar except that rubber tubing is used, the limb having previously been emptied of blood. The constriction by the tube is only kept up from half to two minutes when it is suddenly withdrawn and flushing of the limb with blood results. This alternate constriction and relaxation is repeated three or four times at a sitting at intervals and may be practised twice daily.

Baths.

The beneficial results of treatment by baths are evidenced by the increasing number of rheumatoid patients who avail themselves of this treatment, these benefits do not depend so much upon the particular character of the mineral water as upon the special application of the water, the climatic influences, the dietetic regime and other factors which enter into the course of treatment at the Spa, any benefit that may arise from the internal use of mineral waters will of course depend upon their investigation. Cases associated with anaemia will benefit by drinking cholyheate waters, and those complicated in the portal congestion and hepatic troubles are assisted by the internal use of saline waters.

There can be no doubt that warm baths are more useful than the colder forms of baths, but their

use requires great and special care as abuse is very apt to arise owing to the fact that the hotter forms of baths afford considerable relief to the joints which for a short time are rendered less painful and more easily moved but this relief is only temporary and is obtained at the expense of the general health.

For patients who cannot afford special baths boxes of fine sand heated in the oven may be employed, the hands or feet being buried in the sand.

Hot air baths are particularly suitable for slight cases of rheumatoid arthritis and those with pain and fixation of the joints.

Orthopaedic and Surgical.

Only general indications can be given as each case must be treated according to the signs and symptoms it presents.

The various forms demand different treatment and the appropriate treatment of a case with marked periarticular changes would be harmful to one with hypertrophic changes predominating.

As a guide to surgical treatment a study of X-ray plates is important. These plates will show how much damage has been done to the articular surfaces. If these show little change and the joint has become stiff ~~and~~ forcible tearing apart under anaesthesia is often advisable but this must be followed up by regular massage and passive movements.

Passive movement should be begun within 24 hours and active motion soon after.

Contracted tendons may be divided and the limb straightened. If this is done the joint should not be left in a plaster cast for some time, but passive movements should be begun early.

When one knee is markedly contracted and the other in fair condition, excision of the affected joint may be advisable.

With marked proliferation of the synovial membrane of the knee joint incision and removal of the hypertrophied villi may give much improvement. Bony exostoses causing mechanical difficulty may be removed bony spurs may be removed or the osteophytes round a joint.

Vaccine Treatment.

In the absence of positive knowledge of the infecting organism this treatment can only be empirical. If a culture be made from an affected joint and an autogenous vaccine made from the organism or organisms present, this vaccine is well worth a trial.